

ROT-PROOFING OF JUTE FABRICS BY USING COPPER AMMONIUM CARBONATE SOLUTION

Shamina Jafrin, Md. Kamal Uddin, F. A. Dilruba, Nayer Sultana and H.M. Zakir Hossain

Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka1207
E-mail: sjafrin@gmail.com.

Abstract: *Jute hessian fabrics were treated with copper ammonium carbonate solution to increase its longevity. Two types of Hessians (sized and desized) were treated with various concentration of copper ammonium carbonate solution. To assess the effectiveness of copper ammonium carbonate solution as a rot proofing agent the liquor ratio, tensile strength, copper content and longevity of the treated fabrics were determined. The longevity of the treated jute fabrics were tested by exposing them to the environment in contact with wet soil as nursery pots for seedlings. The treated jute nursery pots exhibited a maximum longevity of fourteen months.*

Key words: *Rot-proofing, Copper ammonium carbonate, Jute fabrics, Longevity, Nursery pot.*

1 INTRODUCTION

At present the world focus is on conserving the environment by using eco friendly technologies and products. The world scientists are consistently exploring to find natural products which can substitute the existing synthetic environmental hazardous products. Jute is an ancient natural fibre, it has been used extensively for its high strength. Jute is also biodegradable and upon degradation creates no adverse effect on the environment. But this rapid biodegradation of the fibre has restrained it from being used in many diversified fields such as nursery pots for seedling; nursery pots require both high longevity and biodegradation to natural elements. Jute degrades quickly when exposed to soil in wet condition, the growth of fungi; micro organisms and weathering is responsible for the degradation. Numerous works have been done world wide to increase the longevity of jute products.

Bangladesh is the second highest producer of jute in the world. Amongst others Bangladesh Jute Research Institute (BJRI) has made considerable progress in increasing the longevity of jute products. Previous workers reported that there are a number of fungi

responsible for decomposing jute and other cellulosic materials [1-3]. Khanum Rabia and Q. A. Ahmed reported that several fungi including *Memnoniella echinata* and *Chaetomium globosum* are also responsible for the degradation of cotton yarns and jute fabrics [4]. There are a number of compounds used for the treatment of jute materials, for protection them from the degradation. [5]

Bhuyian et al used 4% copper sulphate and 1% soda-ash for rot-proofing of sand bags. The treated sand bags along with some control bags were given field trial in the Dhaka Cantonment area with the help of Military personal. They have also indicated from past experience that a copper content of 0.5-2% gives maximum protection of jute fabrics against microbial attack [6].

M. H. Rahman et al have made comparative studies for rot-proofing of jute materials with cuprex and copper naphthenate. Jute fabrics have been treated with various percentage solutions of the two rot proofing agents. From their observations it was concluded that cuprex is the superior and preferable rot proofing agent among the two [7].

Rot proofing experiments of jute materials with various rot-proofing agents showed that copper containing rot-proofing chemicals gave the best result. Copper under suitable conditions is taken by jute in appreciable amounts is bound by chemical combination with the non-cellulosic constituents of jute as reported by Macmilan, Basu and Pal [8]

Shamina Jafrin and others observed that 8% copper sulphate solution and soda ash treated nursery pots possess longevity of more than nine months [9].

2 MATERIALS AND METHODS

2.1 Sample

13 sample specimens of 16" width and 78" lengths were prepared from gray Hessian of the following specifications.

- 12 ends/inch,
- 12 picks/inch,
- 19 oz/yd²,

2.2 Chemicals:

- (i) Copper ammonium carbonate solution (imported from USA)
- (ii) Diastase
- (iii) Lisapol (Wetting agent)

2.3 Machine:

- (1) Mini padding machine
- (ii) Tensile strength Tester, Good Brand and Co. Ltd (UK).

2.4 Experimental procedure:

Prior to the copper ammonium carbonate solution treatment six samples of the gray hessian were desized and six samples were sized. Then the grey hessian fabrics were treated with different concentrations of aqueous copper ammonium carbonate solution in a mini padding machine at the speed of 2m/min under 2 bar pressure. 1-2c.c of wetting agent (lisapol) was added in each treatment. The treated samples were air-dried.

The two types of treated hessian (sized and desized) were compared by evaluating liquor pick up, tensile strength, copper content and longevity of the samples.

2.4.1. Liquor pick up:

Liquor pick up= (Weight after padding- Weight before padding) X100/ Weight before padding.

2.4.2 Determination of tensile strength:

The tensile strength of the treated samples was measured by Constant Rate of Stress method [10] in Good Brand and Co. Ltd Tensile strength Tester, (UK). [Gauge length = 8", Specimen length=20", Specimen width = 5", M/C Rate of travers = 12m/min. Warp way = 10 Specimen, Weft way = 10]. Room temperature was maintained as follows: Temp. = 20⁰ ± 2⁰ C, Humidity = 65% ± 2%

2.4.3 Copper content determination:

The rot proof Hessian was evaluated by determination of copper content in the fabrics by iodometric titration methods [11] and is shown in Tables 1 and 2.

2.4.4 Longevity determination:

Total 50 nursery pots were prepared, filled with compost, sown with seeds (jolie seeds) and kept in the fields. The compost was prepared by mixing 50% (w/w) cow dung and 50% (w/w) soil. The dimensions of each nursery pot was 6 in×7 in.

3 RESULTS AND DISCUSSION

Hessian fabrics were treated with different concentration of copper ammonium carbonate solution for rot proofing. The liquor pick up, tensile strength, copper content and longevity of the rot proof hessian were determined. Optimization of the rate of degradation of treated and untreated jute fabrics are shown in Table 1.

Table 1 Liquor pick up, tensile strength and copper content of original Hessian and desized hessian treated with different percentage of copper ammonium carbonate solution.

Sl. No.	Name of the Samples	Liquor Pick-up (%)	Tensile strength (In lbs)		Copper Content (%)
			Warp	Weft	
1.	Original	-	120	98	-
	Treated with different percentage of copper ammonium carbonate solution				
2.	25%	98	100	80	2.10
3.	17%	95	115	85.5	1.72
4.	12%	94	116	97.5	1.20
5.	10%	97	110	95	0.95
6.	8%	95	107.5	90	0.90
7.	7%	98	101.5	87.5	0.66

It shows in Tables 1 and 2 that the tensile strengths of desized jute Hessian decrease on copper ammonium carbonate solution treatment than the sized control sample. It is

also seen from the table that copper retention of desized hessian is higher than sized hessian.

Table 2 Liquor pick up, tensile strength and copper content of original hessian and sized hessian treated with different of copper ammonium carbonate solution.

Sl. No.	Name of the Samples	Liquor Pick-up (%)	Tensile strength (In lbs)		Copper Content (%)
			Warp	Weft	
1.	Original	-	120	98	-
	Treated with different percentage of copper ammonium carbonate solution				
2.	25%	96	107.5	82.5	1.80
3.	17%	99	127.5	107.5	1.42
4.	12%	95	117.5	102.5	0.82
5.	10%	96	122.5	102.5	0.63
6.	8%	98	117.5	87.5	0.58
7.	7%	97	132.5	95.5	0.55

From the longevity test it was found that untreated nursery pots lost their strength within 15 days of exposure to the environment and were damaged within one month of plantation. On the other hand, the longevity of rot-proof hessian nursery pot is about nine months [9]. The untreated nursery pot degraded easily due to the growth of fungi and other micro-organisms [7].

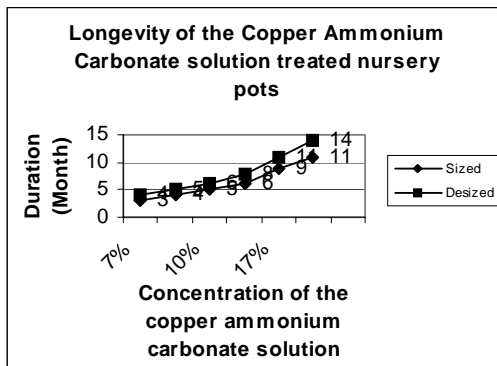


Fig. 1 Durability of the copper ammonium carbonate solution treated nursery pot.

Figure 1 shows that the desized rot proof nursery pots have increased longevity than the sized rot proof nursery pots. The sized rot proof nursery pots degrade quicker because of increased growth of fungi and microorganism on them.

The life of the treated pots is considerably longer than that of the untreated nursery pots. The treated nursery pot shows a gradual decrease with the time of exposure. The longevity of the nursery pot gradually increases with concentration of copper ammonium carbonate solution. The lowest critical limit of the copper ammonium carbonate solution was found to be 7%, for

treatments below this concentration of the solution nursery pots degrade rapidly and the longevity of the pot is less than 2½ months. Treatment with a minimum 12% concentration of copper ammonium carbonate solution is required to achieve longevity of more than 6 months. The copper content of desized treated fabrics is higher than sized treated fabric for any concentration of copper ammonium carbonate solution. That's why nursery pots made of desized rot-proof fabrics has higher longevity than those of sized rot-proof fabrics. The highest concentration of copper ammonium carbonate solution used for treatment was 25%, which resulted in longevity of maximum fourteen months for desized rot-proof nursery pot. In this percentages, longevity of the desized rot-proof nursery pot three months higher than the sized rot-proof nursery pot.

4 CONCLUSION

Nursery pot is one of the basic requirements for plantation in the Bangladesh Forest Division and Private nursery. Once plant was sown in earthen pots, which is now costly. Presently polythene bags/pots were being used as nursery pot for seedling. It does not degrade in case of its disposal after use of nursery pot. In the same time, polythene based nursery pot damage the fertility of the soil. There are some drawbacks of using polythene based nursery pot. Polythene is not environment friendly. It destroys roots due to excess water in the soil. On the other hand, excess water can pass through the jute based nursery pots. The jute based nursery pot

degraded after certain period and ultimately converted into biomass.

To ensure longevity of the jute based rot proof nursery pot maximum fourteen months, it does not involve any critical steps. So copper ammonium carbonate solution treated jute nursery pot is environment friendly.

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Shamina Jafrin is working as a Scientific Officer in the Chemical Processing Department, Bangladesh Jute Research Institute (BJRI),

Dhaka. She obtained her B.Sc and M.Sc degree in Chemistry from National University in 1995 and 1996 respectively.

Md. Kamal Uddin is now working as Chief Scientific Officer in Pilot Plant & Processing Division of Bangladesh Jute Research Institute .He obtained Ph.D in Chemistry from Jahangirnagar University in 2005 and received his M.Sc in Chemistry from Dhaka University in 1991. He has participated in several National and International conferences for presenting his research papers and already published 25 papers in national/international journals. His research interest includes textile pretreatment, dyeing and finishing and diversification of jute through chemical modification. He is a member of the Institution of Textile Engineers and Technologists, Bangladesh (ITET).

F. A. Dilruba was born in Brahmanbaria, Bangladesh. She is now working as a Principal Scientific Officer (Additional Charge) in the Chemistry Division, Bangladesh Jute Research Institute (BJRI), Dhaka. She received her B.Sc. (Hons.) and M.Sc. degree in Chemistry from Dhaka University. She obtained Ph.D. from Chemistry Department of Jahangirnagar University, Savar, Bangladesh.

H. M. Zakir Hossain is now working as Principal Scientific Officer (AC) in Pilot Plant & Processing Division of Bangladesh Jute Research Institute .He obtained B.Sc in Textile Engineering from Dhaka University in 1991. He has participated in Foundation training in BARD, Comilla and obtained Chairman's Award for outstanding performance. The number of his publication is 42 including 16 scientific papers published in national/international journals. His research interest includes physico-mechanical behaviour of dyed jute fabrics and jute waste utilization and diversification of jute through modification. He is a member of the Institution of Textile Engineers and Technologists, Bangladesh (ITET) and also a member of Institution Engineers, Bangladesh (IEB).